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MECHANICS.

247. Proposed by C. N. SCHMALL, New York City.

A cylinder of height h and radius r is standing on a horizontal seat in a railway car while the train is getting under way with an acceleration f. Show that the cylinder will not be disturbed if

$$j<\mu g, \text{ and } f<2rg/h,$$

where μ is the coefficient of friction.

I. Solution by S. G. BARTON, Ph. D., Clarkson School of Technology.

Let m be the mass of the cylinder; then the forces acting are mf horizontally at center of gravity $\frac{1}{2}h$ above base, friction $mg\mu$, horizontally in opposite direction at the base, and mg vertically downward.

The cylinder will not upset unless the moment of the accelerating force about the point of base in the direction of the motion exceeds the moment of mg, that is unless

$$mf\frac{h}{2}>mgr, \text{ that is, it will not upset if } f<\frac{2rg}{h}.$$

It will not slide unless the accelerating force is greater than friction, that is, $mf>mg\mu$; or it will remain at rest if $f<g\mu$.

II. Solution by the late G. B. M. ZERR, Ph. D.

Let F=force that causes sliding or toppling. Then $F=fm$ where mg =weight of cylinder. For sliding to begin, $F=mg\mu$.

$\therefore fm=mg\mu$ or $f=\mu g$. Hence, if $f<\mu g$ there is no sliding.

For toppling to just start, $\frac{1}{2}F.h=rmg$.

Hence, $\frac{1}{2}mfh=rmg$, and $f=2rg/h$.

Then if $f<2rg/h$, there will be no toppling.

No solution of No. 248 has yet been received.

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PROBLEMS FOR SOLUTION.

ALGEBRA.

345. Proposed by E. B. ESCOTT, Professor of Mathematics, University of Michigan.

Solve the simultaneous equations:

$$x^3+y^2z+zw^2-xz^2-2wxy=a\ldots(1).$$
$$y^3+z^2w+wx^2-yw^2-2xyz=b\ldots(2).$$
$$z^3+w^2x+xy^2-zx^2-2yzw=c\ldots(3).$$
$$w^3+x^2y+yz^2-wy^2-2zwx=d\ldots(4).$$